DOCUMENT RESUME

ED 074 088 TM 002 450

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TITLE	Abilities Measured by the Purdue Elementary Problem Solving Inventory.
PUB DATE	Feb 73
NOTE	4p.; Paper presented at the joint session of NCME-AREA, New Orleans, Louisiana, February 1973
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Elementary Grades; *Factor Analysis; Grade 2; *Measurement Instruments; *Problem Solving; *Psychometrics; *Test Results; Test Reviews; Tests
IDENTIFIERS	*Purdue Elementary Problem Solving Inventory

ABSTRACT

The purposes of the present investigation was to factor analyze the results of the administration of the Purdue Elementary Problem Solving Inventory to 361 second-graders. The Inventory was designed to assess twelve distinct skills involved in human problem solving. Tetrachoric intercorrelations were generated from the item scores and a principal axis factor solution with varimax and then oblique rotations was computed. Six psychologically interpretable factors emerged, accounting for approximately 32 percent of the total variance. These six factors corresponded to six of the hypothesized twelve skills involved in the test. Items representative of these factors appeared to assess the ability to sense that a problem exists, define the problem specifically, notice details, see implications, make remote associations, and select the best solution to a problem. (Author)

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Abilities Measured by the Purdue Elementary Problem Solving Inventory

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A paper presented at a joint session of NCME-AERA in New Orleans, 1973.

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ABILITIES MEASURED BY THE PURDUE ELEMENTARY PROBLEM SOLVING INVENTORY

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The purpose of the present investigation was to factor-analyze the Purdue Elementary Problem Solving Inventory (Feldhusen, Houtz, & Ringenbach, in press). The Inventory, described elsewhere in this session and in the literature, was designed to assess twelve distinct skills hypothesized to underlie general problem solving ability (Feldhusen, Houtz, Ringenbach, & Lash, 1971). These skills included: 1) sensing that a problem exists; 2) defining the problem; 3) asking questions about the problem; 4) clarifying the goal in the problem situation; 5) guessing causes; 6) noticing relevant details; 7) using familiar objects in unfamiliar ways; 8) seeing implications; 9) solving problems with only one solution; 10) solving problems which have several possible solutions; 11) verifying solutions; and 12) judging if there is sufficient information presented to solve a problem.

The Inventory contains 49 two- and three-choice items and makes use of cartoon drawings of children in various realistic problem situations. The drawings are presented as slides with an accompanying answer book and audio-tape of directions and picture descriptions.

The Inventory was administered to 361 second-grade Ss from different ethnic and socio-economic backgrounds in Gary, Indiana. All Ss were tested in intact classrooms for a period of 40 to 45 minutes. All items were scored on a right-wrong basis. A tetrachoric intercorrelation matrix was generated since this procedure provides more accurate estimates of binary data correlations (Carroll, 1961). A principal axis factor solution with varimax rotation was then computed (Harman, 1966). The Cattell Scree Test (Cattell, 1966) was used to determine the number of error-free factors. Though this test has been criticized (Guilford & Hoepfner, 1971; Cureton, 1968), the test yielded unambiguous results for this particular set of data. Oblique rotations were carried out on these factors (Cattell, 1966).

The principal axis solution for the item intercorrelation matrix yielded 33 factors. The plot of the eigenvalues of these factors revealed that the Scree slope began at the eigenvalue of the eighth factor. The first seven factors were then rotated to a varimax criterion. In order to interpret these factors, a loading size of .30 or greater or -.30 or less

was considered significant (Guilford & Hoepfner, 1971). Six of the seven factors were interpretable psychologically.

Factor I was represented by 1[illegible] items with significant loadings. These were primarily items originally hypothesized to assess the abilities of solving problems and verifying solutions. However, from an examination of the items it was concluded that the intellectual acitivity most represented was an evaluation of each alternative for a best solution to the problem given, where the problem was somewhat ambiguously stated.

Factor II was represented by 11 items with significant loadings. A number of different item types were represented, but it appeared that the common intellectual activity underlying the items was the ability to perceive critical elements of details in the problem pictures. Factor III involved eight items. These corresponded to the items hypothesized to assess the ability to sense whether or not a problem or difficulty was present. Factor IV was represented by eight items. Four of these items corresponded to the hypothesized ability to define the problem.

Factor V was represented by six items, three of which also had significant loadings on other factors. The underlying intellectual activity appeared to be seeing implications of a course of action. Several of the items hypothesized to assess this ability did, in fact, load significantly on this factor. Finally, Factor VI was represented by four items, with several hypothesized item types represented. It appeared, however, that the ability to make remote or unusual associations was involved in the solution of each of these problems.

Of the twelve types of items designed for the Purdue Problem Solving Inventory, this factor analysis confirmed that six of the hypothesized skills involved in problem solving were, indeed, measured by items of the Inventory. These included: selection of the best solution, noticing critical details, sensing that a problem exists, defining the problem, foreseeing consequences, and redefining common objects in unfamiliary roles. These results provide evidence for the construct validity of the instrument in that there is factorial evidence for several problem solving abilities involved in the test.

In addition, the results correspond to those of Merrifield, Guilford, Christensen, and Frick (1962), who found that the tests sharing the most common variance with problem solving measures were those which weighed heavily on the factors of cognition of semantic units (Noticing details), cognition of semantic implications (seeing consequences), and evaluation of semantic implications (selection of the best solution). Thus, it would appear that the Purdue Elementary Problem Solving Inventory is a valid instrument for the measurement of a number of skills important to problem solving among second-graders.

REFERENCES

Carroll, J. B. The nature of the data, or how to choose a correlation coefficient. Psychometrika, 1961, 26, 347-371.

Cattell, R. B. (Ed.). Handbook of multivariate experimental psychology. Chicago: Rand-McNally & Company, 1966.

Cureton, E. E. A factor analysis of Project TALENT tests and four other batteries. Pittsburgh, Penna.: American Institutes for Research, 1968.

Feldhusen, J. F., Houtz, J. C., & Ringenbach, S. Development of the Purdue Elementary Problem-Solving Inventory. Psychological Reports, in press.

Feldhusen, J. F., Houtz, J. C., Ringenbach, S., & Lash, A. Review of problem-solving measurement tasks. A critical/theoretical paper presented at annual meeting of the American Psychological Association, Washington, D. C., September, 1971.

Guilford, J. P., & Hoepfner, R. The analysis of intelligence. New York: McGraw-Hill, 1971.

Harman, H. H. Modern factor analysis (Second Edition). Chicago: University of Chicago Press, 1960.

Merrifield, J. R., Guilford, J. P., Christensen, P. R., & Frick, J. W. The role of intellectual factors in problem solving. Psychological Monographs, 1962, 76, Whole No. 529.